

May 17, 2013

Health Study of Airborne Manganese (Mn) Exposure in Ohio Adults

What is the Regional Applied Research Effort (RARE)?

RARE is a program that provides EPA an opportunity to conduct scientific research through collaboration between the Regions and ORD.

What is the project?

Two part study: "RARE Part 1" (2009) evaluated exposure to and effects of potential airborne Mn exposure in Marietta OH (near a Mn smelter) and Mt. Vernon OH (less exposed comparison community). "RARE Part 2" (2011) adds a similar evaluation in East Liverpool OH adults. The same researchers conducted both parts with similar methods to allow data comparison.

Why did we do a health study?

In order to (1) address citizen (Marietta and E. Liverpool, OH) concerns and requests for a health study; (2) address an OH EPA petition to ATSDR for a health evaluation of East Liverpool airborne metals; and (3) improve science regarding exposure to and effects of chronic low level airborne Mn exposure in residential communities, an EPA Region 5 concern for more than a decade.

Who participated in the study and what role did each play?

- ATSDR: funding (ambient monitoring), technical expertise (risk and modeling), community relations
- EPA-ORD: initial study proposal, funding, Project Officer, technical expertise, blood chemistry
- EPA-Region 5: initial study proposal, technical expertise (risk and modeling)
- Ohio Department of Health: community relations, technical review
- Ohio EPA: technical review, ambient monitoring
- San Francisco State University (SFSU) and collaborators: Grantee/Contractor/Principal Investigator, study design, health study data collection

How was the study conducted?

An **exposure index** (Mn ambient air concentration, residence duration, distance from source) was derived that included air dispersion modeling and air monitoring data. **Health data** were collected from questionnaires (general health, diet, medications etc.), medical and neuropsychological evaluation (interview, neurologic exam, blood sample etc.) and neurobehavioral tests (movement, balance, mood, etc.).

What are the study results?

For "RARE Part 1" – Marietta and Mt. Vernon OH (complete):

- The study showed subtle, subclinical effects (undetectable by lab test or clinical examination) on movement and anxiety

For "RARE Part 2" – East Liverpool OH (preliminary):

- The study showed no differences between towns for general health, dietary Mn, blood Mn, blood lead, mood, tests of attention and memory
- The study showed slight or very mild subclinical effects for tremor, postural sway, and slower movement initiation

Both Marietta and East Liverpool have elevated Mn air concentrations, however, health effects indicative of Mn exposure were fewer and more subtle than in similar studies of industrial workers who had much higher exposures. In addition, study results suggest that citizens living closer to the Mn source, were associated with borderline to mild tremors and slightly lower motor speed and strength than those living farther away.

What mitigation steps have been taken?

State and federal inspections and air monitoring have been conducted in and near the sources in both Marietta and East Liverpool. Ohio EPA issued 2008 and 2010 Findings and Orders to the East Liverpool Mn source, S.H. Bell, requiring emissions and dust control, road paving and process changes that appear to have lowered monitored airborne Mn. The Marietta source, Eramet-Marietta, is subject to the ongoing Ferroalloys Production Risk and Technology Review rulemaking (final rule late 2013).

What are implications of the study?

The study can inform the science and reduce exposures in the community. More specifically:

- Health education: residents have been informed on their personal exposures and health status, and can be educated about ways to reduce or avoid exposure.
- Emissions reduction: to reduce residential risks for identified health outcomes, the company could evaluate their processes for ways to further reduce emissions.
- Scientific Knowledge Base: the study yields important information about the health implications of chronic, low level manganese exposure in residential populations. Most toxicity data and gleaned from animal and occupational studies, which do not represent the most sensitive individuals in a population.

What steps are next?

- Citizens have been notified of their personal test results
- Preliminary “RARE Part 2” results will be presented at 7/11/13 East Liverpool Health Board and evening community meetings
- Plan for Board and community meetings:
 - SFSU Principal Investigator, ATSDR, OH EPA will make presentations
 - OH Dept. of Health will facilitate
 - EPA-ORD, R5 staff attending will respond to questions
 - Audience will be directed to EPA-ORD website for study-related Mn information
- The Principal Investigator will submit the results to science journals for publication
- Continue East Liverpool and Marietta outdoor air Mn monitoring
- Continue oversight of S.H. Bell and compliance with Clean Air Act and Ohio Laws, regulations, Findings and Orders
- Assess need for additional enforcement actions